DESIGN AND DEVELOPMENT OF A MOUSE BY 3D SCANNING

Project Report
Submitted by

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I would like thank to our other professors and all laboratory maintenance staff for providing me assistance in various hardware and software problem encountered during course of our project.

I am also thankful to my friends who helped me in conducting surveys by observing some regular mouse users to get an unbiased opinion to meet the necessary demands of the mouse so that it can be fit to the least and max percentile of mouse users.

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CERTIFICATE

This is to certify that the under done project work titled “DESIGN AND DEVLOPMENT OF AN MOUSE” is an original creation of Arindam Chanda pursuing final year B.Tech at NIT Rourkela. It is hereby declared that he has completed the final year research project by the end of 8th semester and the above project work has not been done by anyone for the certification of any Graduate, Master or Phd degree. The concept was originally thought, conceptualised and analysed to give it a shape. The concept is not borrowed from any outside sources but pictures for better understanding has been taken from internet and the citations is given below and the concepts were understood thoroughly and the results inferred were based on facts, figures and data’s corresponding to it. Original data was taken into consideration no manipulation was done to get the desired result.

Declaration: The results, analysis, concepts are original contemplations of the student and hence has no problem in declaring that Arindam Chanda has successfully completed the project taking the maximum possible consideration possible.

(Thesis Supervisor)

Prof BBVL Deepak

Assistant Professor

ABSTRACT

In this project the product that is considered for study and design using Faro Arm is Mouse. Different models would be taken and scanned using a Faro Arm. The scanned images will be drafted into CAD files and rendered to get tentative prototypes. The final product and prototype will be produced using RP concepts to get a clear and distinct image. Ergonomics data's is considered for alterations and manipulation to get a new design. Different aesthetic data's of different models are taken and integrated to get a new design. The product generated due to scanning will undergo solid freeform tessellation and slicing and then post furnishing will be done. Here a 3D scanner will be used for scanning. A 3D scanner is a device that analyzes a real-world object or environment to collect data on its shape and possibly its appearance (i.e. colour). The collected data can then be used to construct digital, three dimensional models. Many different technologies can be used to build these 3D scanning devices; each technology comes with its own limitations, advantages and costs. Many limitations in the kind of objects that can be digitized are still present, for example, optical technologies encounter many difficulties with shiny, mirroring or transparent objects collected 3D data is useful for a wide variety of applications. These devices are used extensively by the entertainment industry in the production of movies and video games. Other common applications of this technology include industrial design, orthotics and prosthetics, reverse engineering and prototyping, quality control/inspection and documentation of cultural artifacts. The purpose of a 3D scanner is usually to create a point cloud of geometric samples on the surface of the subject. These points can then be used to extrapolate the shape of the subject (a process called reconstruction). If color information is collected at each point, then the colors on the surface of the subject can also be determined.

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CHAPTER 1

INTRODUCTION

1.1 3D Scanning And Scanner

A 3D scanner is a gadget that outputs a current object of environment to gather information on its shape and then again its appearance (i.e. shade). The gathered information can then be utilized to construct advanced, 3d models. Numerous diverse innovations might be utilized to assemble these 3d examining gadgets; every innovation accompanies its detriments, focal points and charges. Numerous disservices in the sort of questions that could be digitized are still present, for instance, optical innovations face numerous challenges with radiance, replicating or transparent articles. Gathered 3d information is valuable for a reach of provisions. These gadgets are utilized generally by the diversion business really taking shape of films and feature recreations. Different employments of this engineering incorporate mechanical configuration, figuring out and prototyping, quality control/quality check and documentation of social relics. An organized-light 3d scanner is a 3d filtering gadget for measuring the three-dimensional state of an article utilizing light examples that are focussed to it and utilizing a Polaroid based framework.

1.2 Principle

Focussing a band of light (limited) onto a 3d formed surface processes a line of brightening that seems not as the genuine surface projections other than the projector, and might be utilized for an accurate geometric building of the vault shape (light area). A speedier and more dynamic strategy is the centering of examples comprising of numerous stripes without a moment's delay, or of distinctive edges, as this takes into consideration the certification of a wide assortment of specimens at the same time. Seen from diverse edges, the example shows up geometrically cumbersome because of the upper vault surface state of the item. In spite of the fact that numerous different varieties in organized light focussing are conceivable, inductions of parallel stripes are generally utilized. The picture indicates the geometrical misshapening of a solitary stripe anticipated onto a straightforward 3d surface. The moving of the stripes considers an accurate inversion of the 3d directions of any data's on the item's volume, shape and size of the surface.

CHAPTER 2

LITERATURE REVIEW

As machines progressively get imperative in people groups live, numerous human-workstation connection routines are acquainted with empower as numerous users‟ conceivable access workstations. Throughout the pattern in Human workstation cooperation new systems were uncovered to make frameworks usable to clients, to guarantee that clients need to utilize them once more.

2.1 Human Computer Interaction

Human workstation connection is the investigation of individuals, machine innovation, and the ways these impact one another. Be that as it may, in practice Jacko et al characterize HCI as, "a train that includes the configuration, assessment and execution of intelligent figuring frameworks for human utilization. As per Yee, HCI alludes to: "the way a human and workstation impart utilizing set of physical and coherent standards." Hence, Yee alludes to the way an individual encounters machine frameworks. The HCI discipline has advanced predominantly because of two main thrusts to be specific: the advancing nature of workstations, and the yearning for all the more compelling and constraining client experience. The progressions in human workstation cooperation have prompted movements in association standards. Taking a step retrogressive, in the 50s and 60s there was no genuine association standard. Information was entered through switches or punched cards and yield was processed through punched cards or lights. In the 70s, order-line interfaces (standard) were presented whereby communication was just through content. This collaboration had issues of having inflexible conventions which restricted the force of machines. In the 80s the graphical clients interface (GUI) and the desktop similitude in XEROX PARC were presented. This standard is best portrayed by the acronym WIMP (windows, symbols, menus, and an indicating gadget). Notwithstanding the desktop standard being extremely valuable for giving an immediate control style of communication, the two constrains; the developing nature of workstations and the yearning for all the more influential and propelling client experience, have guided change in interface plan. HCI has a tendency to be described by new method for connection which are characteristic, versatile, instinctive and subtle

and copy human-human correspondence. The presentation of such connection strategies has profited numerous clients incorporating those with engine weaknesses. In particular, planned are interfaces with a reach of inputs and yields it gives. The accompanying segment illustrates diverse HCI frameworks whereupon an interface is based. Configuration and execution of human workstation interface following framework focused around numerous eye characteristics". For human eye (Iris) recognition, group mode is utilized. Iris following strategy is actualized on static pictures. This strategy essentially works when the heading of iris is left, right or focus. In the event that the position of iris is up or down, it doesn't work. The framework not works progressively. It is not master to handle squints and close eyes. This paper is pointed for planning and executing a human machine interface framework that tracks the course of the human eye. The specific movement and additionally heading of the iris is utilized to drive the interface by situating the mouse cursor therefore. The area of the iris is finished in clump mode. This implies that the edges are put away in a changeless stockpiling gadget and are recovered one by one. Each of the casings is handled for discovering the area of the iris and consequently setting the mouse cursor thusly. Such a framework, to the point that locates the iris position from still pictures gives an exchange information modality to encourage machine clients with extreme inabilities. "Factual models of appearance for eye following and eye flicker discovery and measurement". Active Appearance Model (AAM) a proof-of- idea model for the eye locale is made to focus the parameters that measure the level of eye flickers. In the wake of creating an eye show, a flicker identifier is anticipated. The primary point of interest of utilizing AAM method is that the itemized portrayal of the eye is acquired and not only its unpleasant area. The fundamental detriment of AAM procedure is that it is intended to work for a solitary singular and furthermore the flicker parameters must be distinguished ahead of time. "Synchronous eye following and flicker recognition with intuitive molecule channels". [5] Eye position is discovered utilizing eye distinguishment calculation. At that point these channels are utilized for eye following and squint identification. For depicting state move, auto relapse models are utilized. A factual dynamic appearance model (AAM) is created to track and distinguish eye squinting. The model has been intended for varieties of head posture or

CHAPTER 3

CONCEPTS USED IN FLOW OF WORK

3.1 Functionality

A 3D scanner normally makes geometrical shapes utilizing point cloud information on the surface of the subject. Extrapolation of the state of the item is conceivable through these focuses (a methodology called remaking). Shades on the surface might be resolved if shade data could be gathered. 3d scanners offer numerous similitudes with Polaroids. Like Polaroids, they have a cone-like field of perspective, and like Polaroids, they can just gather data about surfaces that are not darkened. Field and profundity of perspective are the fundamental hotspots for determination of pictures of a Polaroid, a 3d scanner gathers separation data about surfaces inside its field of perspective. The "picture" transformed by a 3d scanner depicts the amount a point is separated from the scanners Polaroid. This permits the recognizable proof of separation of item. In the greater part of the circumstances, once examining won't have the capacity to handle the model of the article. Numerous outputs, even hundreds, from numerous distinctive bearings are typically needed to acquire data about all points of the article. A reference point is taking where all checking are taking in understanding to it, a process that is generally called arrangement or enlistment, and afterward incorporated to make the genuine model. This entire methodology, going from the single reach guide to the entire model, is generally known as the 3d checking pipeline.

3.2 Generation Of Patterns

There are two real techniques for stripe design era that have been lime lighted: Laser impedance and projection. The laser impedance technique works with two wide planar laser pillar fronts.equidistant,regularity is their outcomes which have been since a long time ago induced. Changing of point between the shafts changes the shape and numerous different characteristics. Fine examples and the profundity of the field (boundless) might be effortlessly made with the assistance of this procedure. Confinements are high cost of usage, troubles giving the real, true,

perfect bar geometry, and laser average impacts like low recurrence commotion and the conceivable impedance toward oneself with bar parts reflected from items. Normally, there is no method for adjusting unique stripes, for example, with Gray codes. Focussing is carried out utilizing a non-cognizant light and functions as a feature projector/displayer. Commonly a fluid precious stone presentation (LCD) or fluid gem on silicon (LCOS) showcase is obvious inside the projector. Advanced light transforming is carried out by exclusive projection (DLP; moving micro mirror) shows. High intensities of light are permitted since DLP ingests much light source. As they are directed by beat length adjustment, a straight ash feature proliferation is felt. Because of pixels created the key stripes which are anticipated have numerous discontinuities and structures misshaped pictures. Smallest defocus is uniformly found in little limits thus these little limits might be directed against the test examination. One Polaroid and one strip is discovered commonly in measuring the projections of ordinary measuring. Numerous convoluted requisitions find their use utilizing two Polaroids on either side for better view and projection. Imperceptible (or impalpable) organized light uses organized light and keeps away from disarray without meddling with the machine vision undertakings. Sample systems incorporate the utilization of infrared light or of to a great degree high casing rates substituting between two accurate inverse examples.

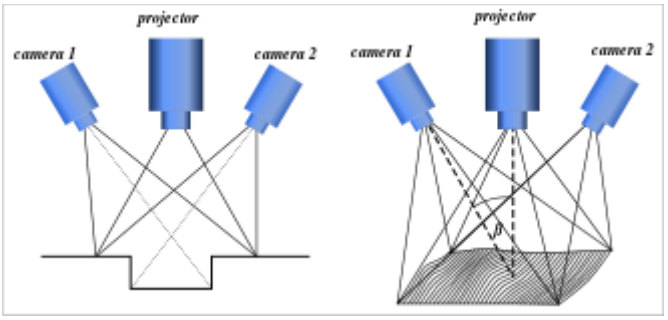

Fig-3.1 Tessellated images

3.3 Calibration

Geometric contrasts by optics and perspective point wonder must be remunerated by an alignment of the measuring gear, utilizing extraordinary adjustment examples and surfaces. A scientific model is utilized to portray the imaging properties of projector and Polaroids. Basically focused around the straightforward geometric properties of a pinhole Polaroid, the model

additionally needs to consider the geometric contortions and optical variation of projector and Polaroid lenses. The parameters of the Polaroid and its introduction in space could be controlled by an arrangement of adjustment estimations, utilizing photogrammetric pack adjustment.

3.4 Analysis Of Patterns

There are a few profundity signals held in the watched stripe designs. The uprooting of any single stripe can specifically be changed over into 3d directions. For this reason, the singular stripe must be distinguished, which can for instance be achieved by following or checking stripes (design distinguishment system). An alternate basic technique tasks exchanging stripe examples, bringing about parallel Gray code arrangements recognizing the amount of every individual stripe hitting the article. An essential profundity sign likewise comes about because of the changing stripe widths along the item surface. Stripe width is a capacity of the steepness of a surface part, i.e. the principal subsidiary of the rise. Stripe recurrence and stage convey comparable signals and might be examined by a Fourier convert. At last, the wavelet convert has as of late been talked about for the same reason. In numerous useful usage, arrangement of estimations joining together example distinguishment, Gray codes and Fourier change are gotten for a complete and unambiguous reproduction of shapes. An alternate strategy likewise having a place with the zone of periphery projection has been showed, using the profundity of field of the Polaroid. It is additionally conceivable to utilize anticipated examples essential as a method for structure insertion into scenes, for a basically photogrammetric obtaining.

3.5 Precision And Range

The optical determination of periphery projection strategies relies on upon the width of the stripes utilized and their optical quality. It is additionally restricted by the wavelength of light. A great decrease of stripe width demonstrates wasteful because of limits in profundity of field, Polaroid determination and showcase determination. Hence the stage shift technique has been generally settled: various no less than 3, normally about 10 exposures are brought with somewhat moved stripes. The primary hypothetical derivations of this technique depended on stripes with a sine wave molded force tweak, however the systems works with "rectangular" tweaked stripes, as conveyed from LCD or DLP shows too. By stage moving, surface subtle element of e.g. 1/10 the stripe pitch could be determined. Current optical stripe design

profilometry consequently takes into account point of interest resolutions down to the wavelength of light, underneath 1 micrometer in practice or, with bigger stripe examples, to approx. 1/10 of the stripe width. Concerning level precision, interjecting over a few pixels of the obtained Polaroid picture can yield a solid tallness determination and additionally exactness, down to 1/50 pixel. Self-assertively expansive items might be measured with appropriately huge stripe examples and setups. Pragmatic requisitions are recorded including protests a few meters in size.Typical accuracy figures are:

Planarity of a 2-foot (0.61 m) wide surface, to 10 micrometers (0.00039 in).

Shape of a motor combustion chamber to 2 micrometers (7.9×10−5 in) (elevation), yielding a volume accuracy 10 times better than with volumetric dosing.

Shape of an object 2 inches (51 mm) large, to about 1 micrometer (3.9×10−5 in)

Radius of a blade edge of e.g. 10 micrometers (0.00039 in), to ±0.4 μm

3.6 Navigation

As the strategy can measure shapes from one viewpoint just at once, finish 3d shapes must be consolidated from diverse estimations in distinctive edges. This could be achieved by joining marker focuses to the article and consolidating viewpoints a while later by matching these markers. The methodology could be computerized, by mounting the item on a mechanized turntable or CNC situating gadget. Markers can too be connected on a situating gadget rather than the article itself. The 3d information accumulated could be utilized to recover CAD (workstation helped configuration) information and models from existing segments (figuring out), hand structured examples or figures, regular items or antiques.

Fig-3.2 Navigated Images

3.7 Reconstructing Optically Challenged Objects

Likewise with all optical strategies, reflective or transparent surfaces raise troubles. Reflections cause light to be reflected either far from the Polaroid or directly into its optics. In both cases, the element reach of the Polaroid could be surpassed. Transparent or semi-transparent surfaces additionally cause real troubles. In these cases, covering the surfaces with a flimsy dark polish only for measuring designs is a typical practice. A late strategy handles profoundly reflective and specular protests by embeddings a 1-dimensional diffuser between the light source (e.g., projector) and the item to be checked. Elective optical methods have been proposed for taking care of superbly transparent and specular articles. Twofold reflections and between-reflections can result in the stripe example to be overlaid with unwanted light, altogether killing the chance for legitimate discovery. Reflective holes and sunken items are along these lines troublesome to handle. It is additionally difficult to handle translucent materials, for example, skin, marble, wax, plants and human tissue in view of the wonder of sub-surface dispersing. As of late, there has been an exertion in the machine vision group to handle such optically perplexing scenes by re-planning the light examples. These techniques have demonstrated guaranteeing 3d checking effects for generally troublesome articles, for example, very specular metal concavities and translucent wax candles.

3.8 Speed

In spite of the fact that few examples must be taken for every picture in most organized light variants, fast-executions are accessible for various provisions, for instance: Inline exactness review of segments throughout the processing methodology. Social insurance provisions, for example, live measuring of human body shapes or the micro structures of human skin. Film provisions have been proposed, for instance the procurement of spatial scene information for three-dimensional TV.

3.9 Applications

The Kinect-Camera from Microsoft is the first consumer-grade application. It uses a pattern of projected infrared-Points to generate a dense 3D-Image.

- made to measure design retailing
- precision shape estimation for creation control (e.g. turbine edges)
- reverse building (acquiring exactness CAD information from existing items)
- volume estimation (e.g. burning chamber volume in engines)
- classification of pounding materials and instruments
- precision structure estimation of pounded surfaces
- radius determination of cutting device edges
- precision estimation of planarity
- documenting objects of social legacy
- skin surface estimation for beauty care products and pharmaceutical
- body shape estimation
- forensic science reviews
- road asphalt structure and unpleasantness
- wrinkle estimation on material and cowhide

.3.10 Contact

Contact 3d scanners test the subject through physical touch, while the article is in contact with or resting on an exactness even surface plate, ground and cleaned to a particular greatest of surface unpleasantness. Where the item to be filtered is not even or can't rest steadily on a level surface, it is backed and held immovably set up by an apparatus. The scanner system may have three separate structures: A carriage framework with inflexible arms held hard in perpendicular relationship and every pivot skimming along a track. Such frameworks work best with level profile shapes or straightforward raised bended surfaces. An explained arm with inflexible bones and high accuracy precise sensors. The area of the end of the arm includes complex math ascertaining the wrist pivot point and pivot edge of each one joint. This is perfect for examining into precipices and inside spaces with a little mouth opening. A combo of both routines may be utilized, for example, a verbalized arm suspended from a voyaging carriage, for mapping substantial articles with inner part pits or covering surfaces. A CMM (coordinate measuring machine) is a case of a contact 3d scanner. It is utilized basically as a part of assembling and might be extremely exact. The disservice of CMM however, is that it obliges contact with the

article being checked. Hence, the demonstration of filtering the item may alter or harm it. This is exceptionally huge when examining fragile or significant questions, for example, recorded antiquities. The other inconvenience of CMM is that they are generally moderate contrasted with the other examining techniques. Physically moving the arm that the test is mounted on might be moderate and the speediest CMM can just work on a couple of hundred hertz. Interestingly, an optical framework like a laser scanner can work from 10 to 500 khz. Different cases are the hand driven touch tests used to digitize mud shows in workstation movement industry.

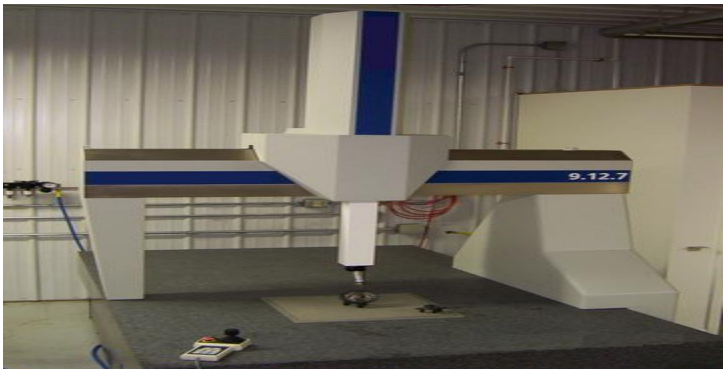

Fig-3.3 Contact Scanning

3.11 Faro Arm

The Faro Arm is a portable coordinate measuring machine (CMM) that allows manufacturers easy verification of product quality by performing 3D inspections, tool certifications, CAD comparison, dimensional analysis, reverse engineering, and more. The all-new FARO Edge is the most advanced, state-of-the-art FaroArm ever produced.With the ScanArm, the addition of the FARO Laser Line Probe to the FaroArm adds unparalleled non-contact 3D scanning capabilities for detailed measurement of surface form, making the ScanArm the perfect combination of a contact and non-contact portable CMM**.**

Fig -3.4 Faro Arm Scanners

3.12 Features Of Faro Arm

FARO Edge Technicalities present in lab

0.8 to 1.7m (3 ft. to 6 ft.) spherical working volume

Accuracy from 0.024mm (0.0009 in.)To0.064mm(0.0025in.)

Intuitive on-board measurement system: Built-in touchscreen computer; Quick Tools; Laptop-free basic measurements

Smart Sensor Technology: Sensors warn against factors that compromise performance

Internal Counterbalance: Provides comfortable, stress-free usage

Temperature Sensors: Allow the Arm to react to thermal.

3.13 Applications Of Faro Arm

- Automobile
- Aerospace
- Die Manufacturing
- Dimensional Analysis
- Quality control
- Machine Alignment
- Rapid Prototyping
- First Article Inspection
- Part Verification

- Reverse engineering

Fig-3.5 Quickly identify deviations from nominal CAD data with 3D metrology

(CAD inspection)

Fig-3.6 Quickly capture measurements, perform inspections and ensure proper.(Dimensional Analysis)

Fig-3.7 Ensure first article parts meet design specifications and tolerances

(First Article Inspection)

Fig-3.8 Inspect parts in-process, directly on or at the machine producing them (In-Process Inspection)

Fig-3.9-Prevent out-of-tolerance parts from reaching assembly with incoming Quality.(Incoming Inspection)

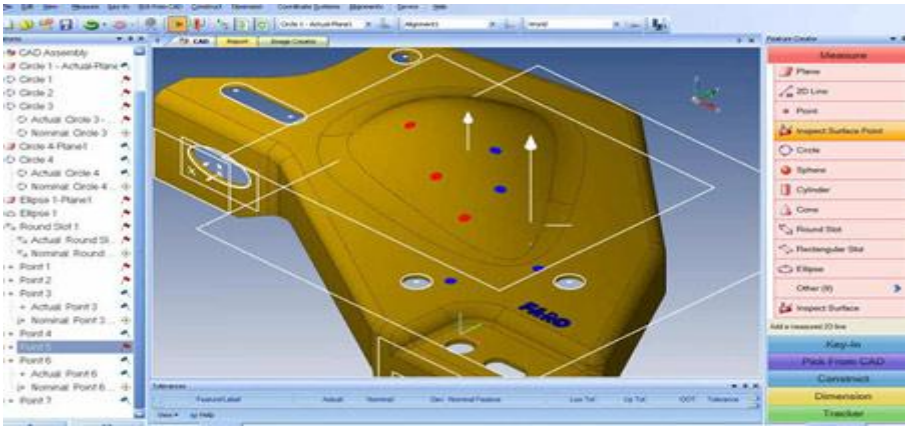

Fig3.10-Create fully surfaced CAD models of design concepts or replacement parts.(Reverse Engineering)

Fig 3.11-Ensure machines are calibrated and operating at optimal performance with (Machine Calibration)

Fig 3.12-Increase machine performance and reduce downtime caused by misalignment (Alignment)

3.14 Problem statement

To design and design a mouse by using 3d scanning technique through a faro arm for future trends.

CHAPTER 4

METHODOLOGY

4.1 Goals

- Reduce the weight
- Aesthetics of the vehicle
- Reduce ergonomics constraints
- Efficient usage/flexibility
- Unconstrained bending.
- Maximum movement possible

4.2 Innovation

- Mouse , its leaning position
- Unconstrained hand movement.
- Unassisted start and stop
- Ergonomically efficient manoeuvre

Ergonomically suitable mouse due to less strain on human hands while working with respect to general mice.

4.3 Material Selection

After brainstorming frame geometries, the frame material was determined to balance the various properties of strength, weight, fabrication time, material cost .The material considered were Plastic, Hard Plastic, Polymer ceramic mix. The choice was determined using a decision matrix as documented in Table.1, and it was found that tubular polymer ceramic mix was the best frame material to use.

PROPERTIES	***ABSPLASTIC***	***HARD PLASTIC***	
Density (x1000 kg/m3)	7.9	7.8	

Elastic Modulus (GPa)	200	205	
Poisson's Ratio	0.26	0.28	
Yield Strength (MPa)	207-552	380-1215	
%Elongation	-	-	
Melting Point(^{0}C)	1400	1432	
Brinell Hardness	201 HBW	197-375 HBW	
Bulk Modulus (GPa)	130	-	
UTS (MPa)	620	560-1310	
Elongation at Break (%)	35	12-26	
Strength to Weight Ratio (kNm/kg)	78	71-160	
Shear Modulus (GPa)	100	-	
Fatigue Strength Coefficient (MPa)	876	2294	
Fatigue Ductility Coefficient	0.063	1.443	
Fatigue Ductility Exponent, c	-0.3069	-.7255	
Fatigue Strength exponent, b	-0.1057	-0.1013	

4.4 FEM Analysis Of Polymer Ceramic Mix

Analysis was done on 2 Tubes of hard plastic and ABS plastic to compare the load bearing capacity of the chosen PCM, each of 40mm diameter and 2mm thickness. Loads of 300N was applied on both the tubes and deformation of 0.2mm was found PCM and 0.08mm was found on plastic tube as in Fig.3 and Fig.4. This shows hard plastic having almost same properties as that of ABS plastic and 3 times less dense than ABS plastic the best material to be used but as density is to be considered low so ABS plastic is used.

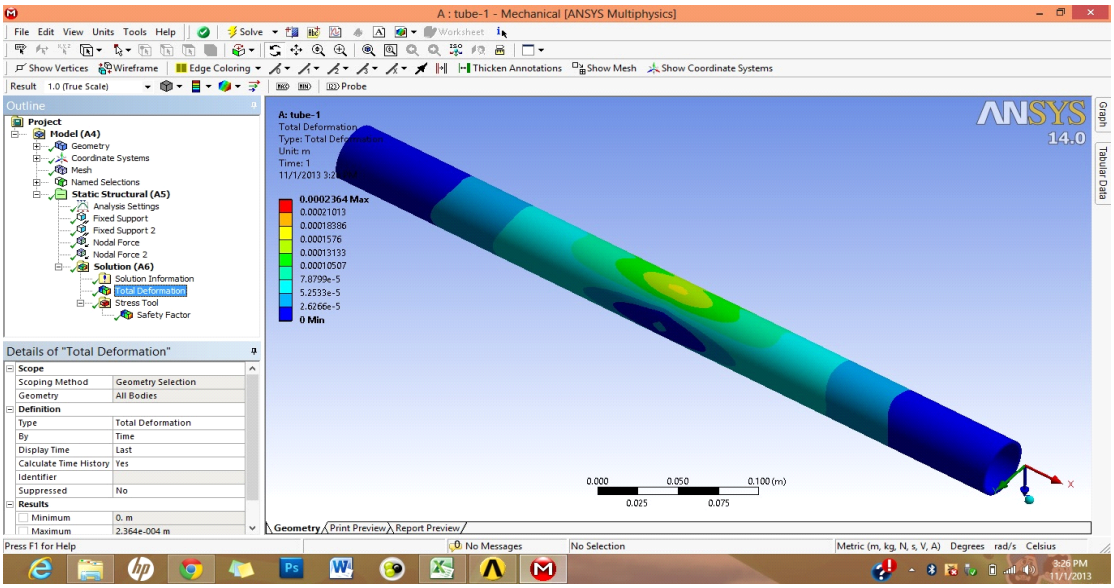

Fig.4.1 ABS Plastic

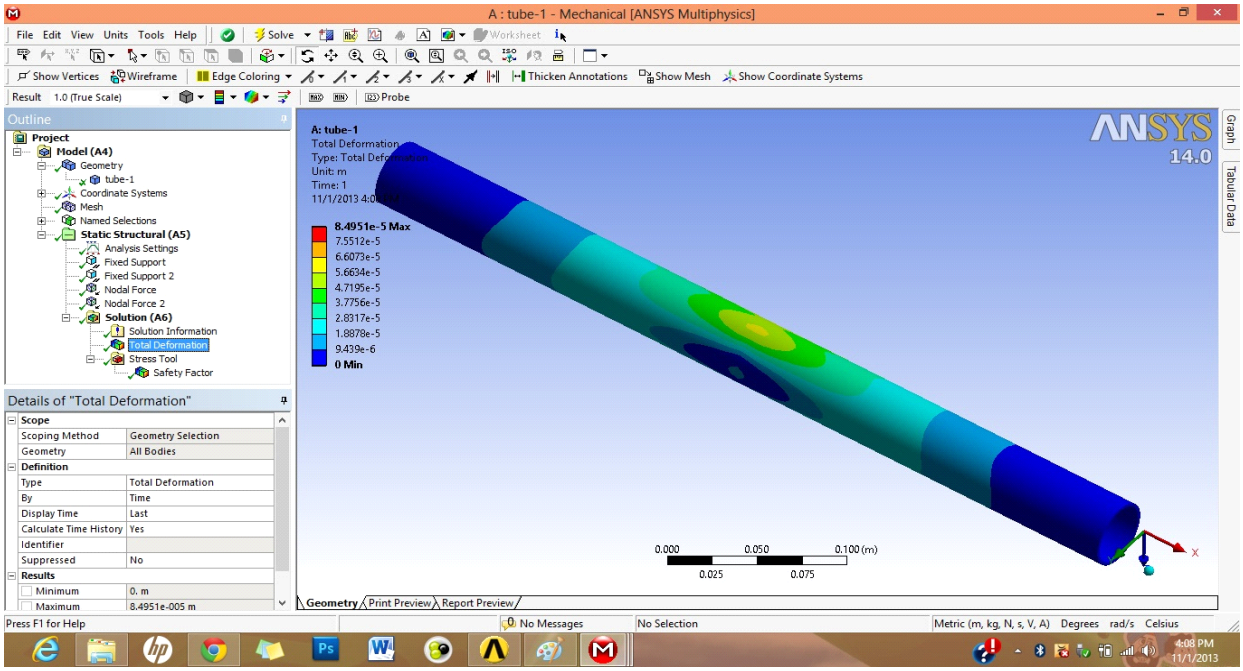

Fig. 4.2 Hard Plastic

4.5 Finite Element Analysis (FEA)

FEA was carried out for analysing the stress and displacement under a static loading.

Analytical Product Design

This analysis was carried out in both the horizontal and the vertical positions. A uniformly distributed load of 50N was applied on the top surface. This force of 50N is the average force applied by the hand while pressing based on results of a study to measure Hand Force Data.The results of the analysis are displayed below**.**

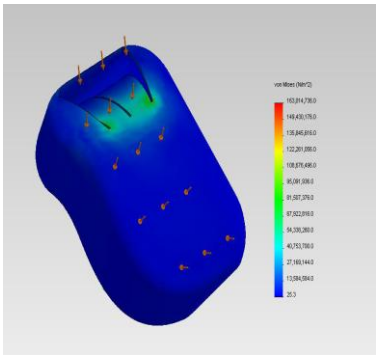

Figure 4.3(1): Horizontal Position-Stress Analysis

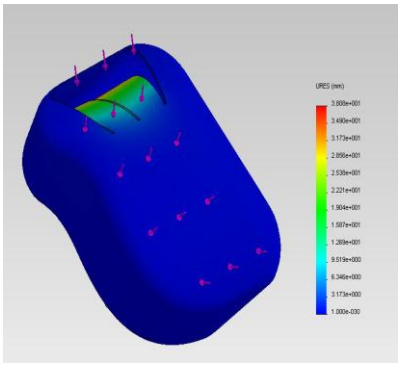

Figure 4.3(2): Horizontal Position- Displacement Analysis

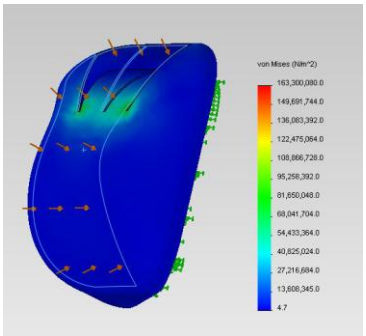

Figure 4.3(3): Vertical Position-Stress Analysis

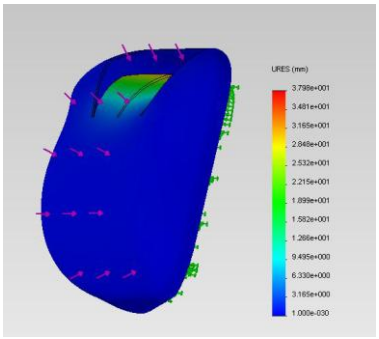

Figure 4.3(4): Horizontal Position-Stress Analysis

4.6 Previous Designs

Few items are there in the business contending with the ergonomic issues with their current outline butare not utilized by the majority of the clients since they are ergonomically compelled or are valued excessively high. This area depicts a couple of the past plans that are at present accessible in the business.

4.6. Evoluent Vertical Mouse

Evoluent Vertical Mouse is an ergonomically steady mouse. A vertical mouse has the catches and parchment wheel on the right half of the mouse. Client treatment of the mouse relies on upon the hand setting on the mouse. Client does not need to curve his arm so this mouse is ergonomically steady. This mouse speaks to the individuals who utilize a mouse for long times of time on the grounds that the client's arm is in a more agreeable position. The current cost of the Evoluent Vertical Mouse is $100.as the cost of the Evoluent mouse is more, this mouse can't be utilized and we will furnish with a finer agreeable mouse. We consolidated the vertical mouse

plan into our last idea in light of the fact that the mouse has a level of solace that is alluring to generally clients.

Figure 4.4 Evoluent Vertical Mouse

4.6.b Pad And Click Gel Pads

An alternate item available is the situated of Pad N' Click gel cushions. To make the clicking of the mouse more agreeable silicon gels are utilized as a part of the catches for smooth moving. The finger curves as opposed to being extended because of the setting of the gel cushions in the catches. Slight curved position is permitted and favored so this specific configuration is favored. An alternate preference of the gel cushions is expense. Retailing at just $5, the Pad N' Click gel cushions are competitive to anybody giving the organization and a wide market of clients to offer to.

Figure 4.5 Pad N’ Click Gel Pads

4.6.c 3M Ergonomic Mouse

An alternate contending mouse in the business is the 3m Ergonomic Mouse. This mouse is by and large an ordinary joystick mouse which has its correct and left clicks catches on the highest point of the joystick.it gets settled over a long time of time since the client puts its hand on the vertical leader of the mouse where the client can feel to rest. The mouse is proposed by the Arthritis Foundation on the grounds that it lessens wrist and carpal tunnel wounds connected

with standard mice. The 3m Ergonomic Mouse costs $52 which is a great cost for clients utilizing mouse for a long time of time, however is excessively high for a general client.

Figure 4.6 3M Ergonomic Mouse

4.6.d Logitech Trackball Mouse

The last contending item is the Logitech Trackball mouse. The trackball mouse is a stationary mouse that has the typical catches a consistent mouse has however has a trackball that the client's thumb moves to control the cursor.

Preferences-The mouse might be utilized as a part of any uneven surface and the client require not move their hands to move the mouse. Disservice-Prolonged utilization of the mouse could be excessively feverish, aggravating, tiresome and exhausting as it turns into a consideration seeker The Logitech Trackball costs $50 which is excessively costly for easy mouse clients.

Figure 4.7 Logitech Trackball Mouse

4.7 Design Objective And Requirements

The essential target of the undertaking is to outline an ergonomic machine mouse for the overall public. Planning such a mouse obliges choice of various variables and streamlining qualities for these variables. The target of the undertaking is to expand the ergonomics and solace of the workstation mouse for the machine client. The other target that is constantly focused on is to minimize the expense in accomplishing the craved solace and usability. A client might need to purchase a mouse that is not difficult to utilize yet in the meantime might not have any desire to pay an extreme cost for it. Different components go about as prerequisites or demands for the configuration of such a mouse. Case in point, one of the necessities is the usefulness of the mouse. It is vital that the mouse has at any rate all the fundamental capacities that a customary mouse does. The accompanying table records the destinations and the necessities for outlining this workstation mouse. It additionally incorporates the measurements that could be utilized to measure these characteristics and likewise the target quality or techniques to measure.

Objective	Metric/Methods for obtaining value	Target Value
Maximize ergonomics	Survey/Jury Decision	Approved by minimum 95% of survey/evaluation users
Maximize comfort	Survey/Jury Decision	Approved by minimum 95% of survey/evaluation users
Minimize Cost	Dollars ($)	30$

Requirements/Constraints	Metric/Methods for obtaining value	Target Value/Range
Maintain Functionality	No. of functions (clicks, scroll etc.)	At least all functions of a regular mouse (Clicks and scroll)
Weight	Grams	< 150gms
Interface	USB connectivity (Version 1.0 or 2.0)	USB 1.0 compatible with 2.0
Operating System Requirement	OS versions (Win XX, Mac)	Win 98 and above + MAC
Surface Texture	Survey/Jury based	Approved by minimum 95% of

4.8 Product Processing Chart

The item preparing diagram predominantly portrays the business worth of the item with a built connection with the Cost of the item and solace of the item. Item improvement dissection has

dependably been inferred from the item transforming diagram and this has a more extensive and ghastic effect on all item life cycle. The underneath graph best depicts our item in the business dissecting all conceivable elements.

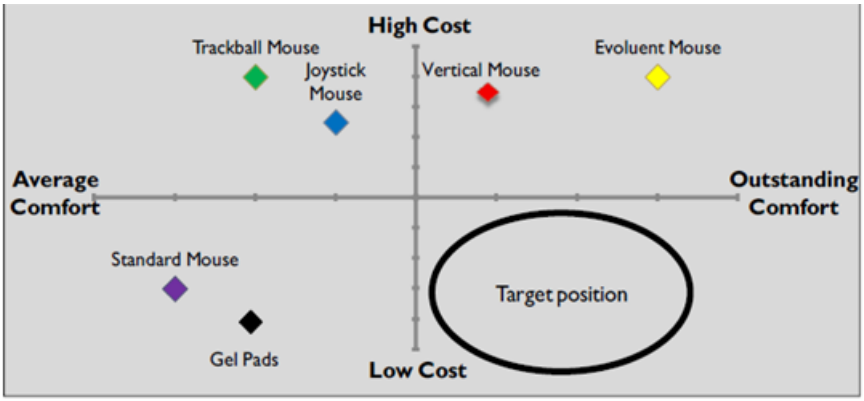

Fig 4.8-Product Development Analysis

4.9 Concepts

4.9.1 Concept generation, selection and analysis

Here we deal with the number of concepts that has aroused and the maximum possible designs are analysed and the final design is taken into consideration.

4.9.2 Concept Design1: Mouse Glove

The mouse glove is intended to dispose of the more customary mouse which is now in practice. Outline Heuristics practice in class gave this thought and was produced, from the card which proposed joining the item to the client. The client wears the outline as a glove, which has a few sensors inherent.

The right click, left click, and parchment capacities of a standard machine mouse is characterized by the movements and developments of the clients. Other hand signals can likewise be characterized by the clients utilizing distinctive developments of the clients. To enhance ergonomic issues this outline was for the most part expected for by letting the client position their hand in whatever position is most agreeable for them, and it likewise is gainful for clients who may have versatility issues in their grasp or fingers by disposing of the need to do customary clicking and scrolling movements.

Fig 4.9- Mouse Glove

4.9.3 Concept Design2: Reconfigurable Buttons

The locations of buttons can be reconfigured is the speciality of this mouse. The mouse which can be moved to different locations on the mouse base which would come with an ergonomic base and detachable, moveable "clickers".

The user is thus allowed to position the button as per its comfort. The users are in an advantageous position since the users may not have pain and stiffness in the joints as the buttons can be reconfigured which is accessible. These mice are reconfigurable for left and right, as hand users which are a secondary benefit as without changing the configuration settings the buttons can be easily reconfigured.

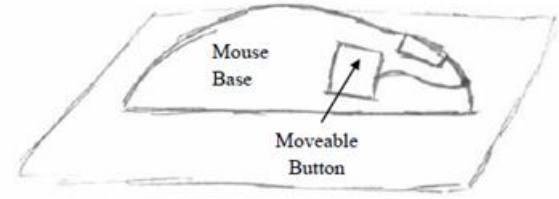

Fig 4.10-Reconfigurable Buttons

4.9.4 Concept Design3: Gel Pads

Gel pads are features that the users can add to the mouse but are not designs that are thought by most of us. These are used to generate comfort among users. Relating to the padding or lift, the user can put the Gel pad wherever it wants to put.

Figure 4.11 Gel Pads

As less motion is required for the more traditional mouse less pain and stiffness is felt in the joints of the users leading to a more comfortable use. The Gel Pads could also provide a more ergonomic grip on the mouse.

4.9.5 Concept Design4: Horizontal/Vertical Mouse

Current ergonomic mouse models include a vertical style which allows the user to use the mouse so their hand is oriented like a handshake, as described above. Traditional usage of the mouse in both vertical and horizontal position was possible by the Vertical/Horizontal mouse. Turning the mouse over 90 degrees and changing the orientation of the mouse from Horizontal to vertical and vice versa was possible because of the two sensors inside the mouse..

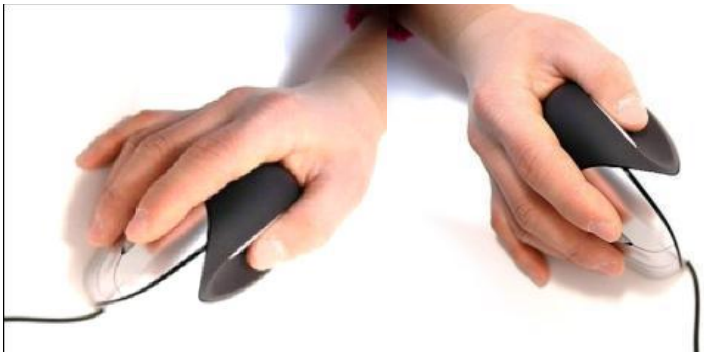

Figure 4.12: Horizontal/Vertical Mouse

The forearm is not twisted when using the traditional mouse so using the more traditional mouse was more ergonomic by nature. Using the Horizontal/Vertical mouse could be used for long periods since no pain could be felt with the forearms and the twists so the utilisation of that mouse was very much comfortable.

4.9.6 Concept Design5: Slide To Click

The Slide to Click design gets that look of the mouse which was used traditionally but alters the traditional function motions. In this design the entire top of the mouse can slide forward, backward, or from one side to the other side to click or scroll,

Figure 4.13 Slide to Click

Where the users have pain and stiffness in joint's and would have difficulty in click or would face the difficulty to slide this would be the best form of motion. The entire hand or palm of the user could be used to control the mouse instead of just their fingers.

4.10 Prototype Selection

A Pugh framework diagram was utilized to investigate all the models with the goal that the best advances out and the best one might be taken for creation. Mouse glove plan and the reconfigurable catches were carried out just in the wake of taking the outcomes of Pugh lattice. The mouse glove was not had the capacity to use by numerous clients as it was thought to be despite the fact that it was ergonomically thought to be more average. Poor scores in the Cost, DFA and Maintenance classes prompted the end of reconfigurable catches.

The group then talked about the remaining idea plans: Gel Pads, Horizontal/Vertical Mouse, and the Slide to Click. It was chosen to take out the slide click mouse choice despite the fact that they had comparable scores with the Horizontal/Vertical mouse since the slide to click had the same score as the datum reference. The Gel Pads and the Horizontal/Vertical Mouse was left for the analysis. Reducing the exertion for clicking is not the prime concern and might not meet to address the ergonomics issues and accordingly Gel cushions which was thought to be incorporated right away was not included later on (since clicking does not include high

requisition of power). The even/vertical mouse was picked with adjustment to the profile of the mouse in all bearings with an expect to augment solace.

4.11 Prototype description

The following section describes the iterations in the design which led to the development of the final product.

4.12 Prototype Evaluation

The alpha model was carried out utilizing earth displaying method. The group had worries about the client's forefinger touching the base of the mouse in the vertical position, so the model had a "lip" where the pointer might alter.

Fig 4.14- Alpha Prototype

The mouse was too unstable and unwieldy in the vertical position and this was concluded from the discussions. The height of the mouse needed to be increased,in order to make the mouse stable in the vertical position,. This would increase the surface area in the vertical position and make the mouse more stable.

Figure 4.15 First Beta Iteration

Advancement of a second dirt model was carried out which was taller and rounder than the alpha model. After examining this outline, it was chosen that the mouse in vertical position was still

precarious. It was observed that an offset fundamental between the tallness and the surface territory in the vertical position, as expanding stature makes a difference. As an elective to these modifications, it was chosen to change the plot between the even and vertical position, making the surface territory of each one position square with.

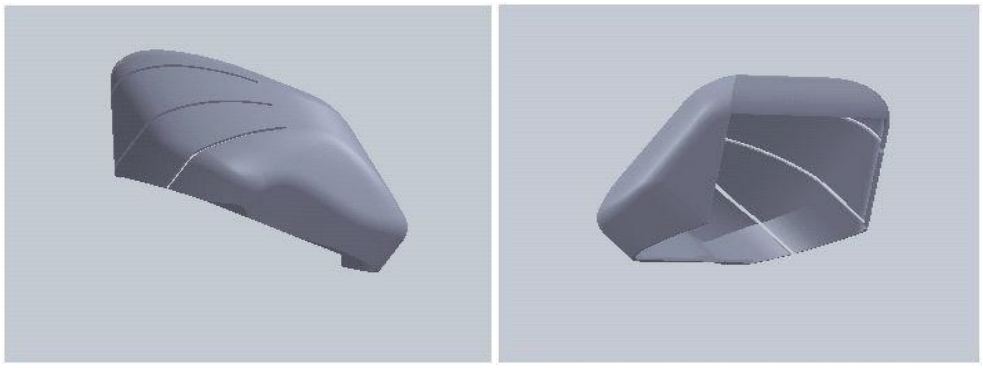

Figure 4.16: Second Beta Iteration

A 30 degree edge between the mouse base and surface in the level position was used for the second Beta cycle. The mouse tilted towards the Left was a gigantic issue, in the even position, as the level position was not emphatically the even position that was examined. This was not in understand ability to the more routine ergonomic "handshake" position. Thus, the left edge of the mouse is connected down to the base so the mouse is truly even in the even position in the last.

Figure 4.17 Beta Prototype

4.13 Beta Prototype Analysis

The most supported arrangement for the customers was taken out of the diagram. Considering the level/vertical mouse Alpha Prototype and the customer inputs from the study, it was reason that in Horizontal position the tallness of the mouse was unnecessarily high. Inconvenience was there to use and not totally ergonomic inside terms of the turn in the customers' arm that was recognized. To address the variance in the bending of the arm, the plot taken for the vertical position of the mouse was modified to 30 degrees that was in soundness to the diagram results.

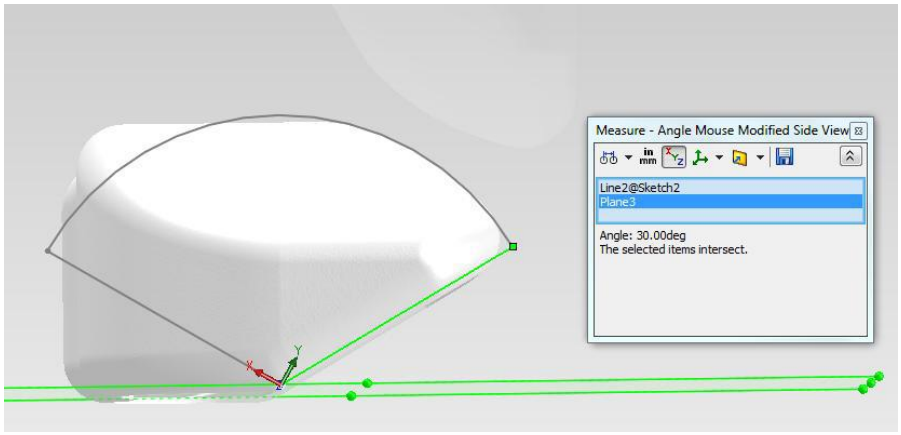

Figure 4.18 Back View of the Computer Mouse

To get the Side view profile of the mouse, the team set up control points along the side profile with the shape varying ability as shown in the figure.

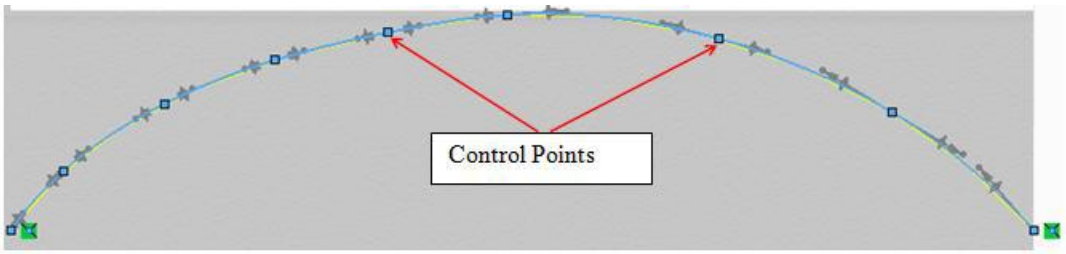

Figure 4.19 Control Points on Side Profile of Mouse

Different profiles were got by changing these control points. The most comfortable position was got by manipulating these control points which was based on the analysis of the survey. Based on the survey results, the profile shown above was chosen for the prototype.

Different profiles were got by changing the location of different points. The most comfortable position for the user was to be decided from the survey. Based on the survey results, the profile shown above was chosen for the prototype.

4.14 Beta Plus Prototype: Modified Horizontal/Vertical Mouse

As portrayed prior, usefulness and ergonomics of current standard and vertical machine mice were incorporated to the flat/vertical mouse which was expected for the sought consolidation. The use of two optical sensors made the conventional mouse responsible to both the level development and vertical development.

The client has the alternative of pivoting the mouse to a more agreeable position for the arm in the vertical position. Flat mouse position style could be represented the more customary holding of the mouse..

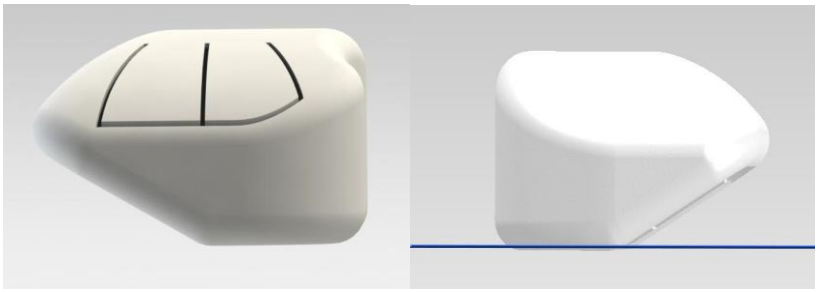

Figure 4.20 Horizontal Position of Mouse

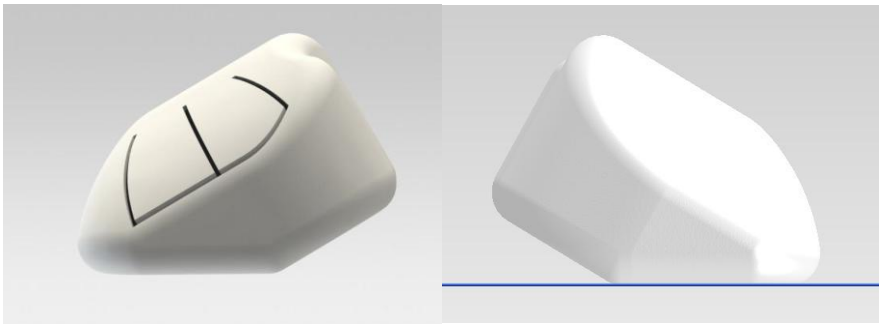

Figure 4.21 Vertical Position of Mouse

The following image shows the side view of the mouse. The profile that is incorporated is taken from the analysis:

Figure 4.22 Side Profile of Mouse

Figure 4.23 Bottom view of Mouse

ABS plastic is the main driver of shell made out of Beta sort model. This was made in the lab utilizing quick prototyping innovations. Our essential center is the ergonomic some piece of the mouse, for which the model is taken for.

CHAPTER 5

RESULTS AND DISCUSSIONS

From the get go determination of material was to be carried out and we were to pick between hard plastic and ABS plastic. So taking a few parameters into contemplations and applying 50N and 100 N power to both the item we found that just about all perceptions were same in both the cases yet it was observed that hard plastic was 3 times less denser than ABS plastic. So ABS plastic (low) was taken as material which could be utilized for model preparation and hard plastic could be rejected. Stress investigation and hand energy information under static stacking was likewise mulled over. Investigation was completed in 2 containers of hard plastic and ABS plastic to analyze the heap bearing limit of the picked PCM, each of 40mm measurement and 2mm thickness. Heaps of 300N was connected on both the tubes and disfigurement of 0.2mm was discovered PCM and 0.08mm was found on plastic tube. This shows hard plastic properties and ABS plastic had same properties yet the above reason lead to the determination of ABS plastic. An alternate dissection was done in both level and the vertical positions. A consistently disseminated heap of 50N was connected on the top surface. This energy of 50N is the normal power connected by the hand while pressing focused around the outcomes to measure the Hand energy information. Model advancement occurred thinking seriously about numerous ideas and after that incorporating each one of those ideas. In the dirt model it was observed that the mouse was excessively shaky and cumbersome in the vertical position and this was finished up in the talks. The tallness of the mouse required to be expanded, with a specific end goal to make the mouse steady in vertical position. This might prompt the expansion in surface territory in the vertical position and make the mouse more steady. Improvement of a second mud model was carried out which was taller and rounder that the prior model. After examining, it was chosen that the mouse in vertical position was still unsteady. It was discovered that an offset was important between the stature and the surface territory in the vertical position, as expanding tallness makes a difference. As an elective to these options, it was chosen to change the point between the level and vertical position, making the surface range of each one position meet. A 30 degree plot between the mouse base and surface in the level position was utilized for the second beta emphasis. The mouse tilted towards the left was a huge issue, in the flat position as the level position was not positively the even position that was discussed. This was not in soundness with

the more customary ergonomic "handshake" position. Therefore, the left edge of the mouse is reached out down to the base so the mouse is genuinely flat in the level position in the last beta model. The most favoured outline for the clients was taken out of the study. In light of the even/vertical mouse Alpha model and the client inputs from the overview, it was reasoned that in flat position the tallness of the mouse was excessively high. Trouble was there to utilize and not completely ergonomic as a part of terms of the turn in the clients, arm that was acknowledged. To address the change in the curving of the arm, the edge taken for the vertical position of the mouse was settled to 30 degrees that was in lucidness to the review results.

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

In this course of time I had taken a mouse and did all the conceivable investigation and got outcomes focused around free structure tessellation and 3d filtering. Numerous Prototypes were gotten and numerous ideas moved yet the last plan at this minute (provisional) will be a coordination of the models acquired and a set of feel data which will make the mouse a benchmark for different organizations. Distinctive profiles were got by changing these control focuses. The most agreeable position was got by controlling these control focuses which was focused around the dissection of the overview. In view of the overview comes about a profile was picked for the model. Diverse profiles were got by changing the area of distinctive focuses. The most agreeable position for the client was to be chosen from the review investigation. In view of the review the profile picked was taken. Usefulness, ergonomics of the current standard and vertical workstation mice were coordinated to the even mouse which was expected for the coveted fusion. The utilization of two optical sensors made the customary mouse responsible to both level development and vertical development. The client has the choice of turning the mouse to a more agreeable position for the arm in the vertical position. Level mouse position might be represented the more customary holding style. The last model which was made was an incorporated model of 3 separate models which were then amalgamated to prepare the best model upgrading cost and taking all DFA/M criteria into the thought. This mouse might be a future pattern for some business sectors since this is holds the best conceivable material utilized thinking seriously about all mechanical elements, best feel look that has been illustrated by individuals on the premise of study, best ergonomic holding that has likewise been taken from the review, enhancing the expense and cutting it down to the most reduced conceivable ever with a speedier generation increase time.

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